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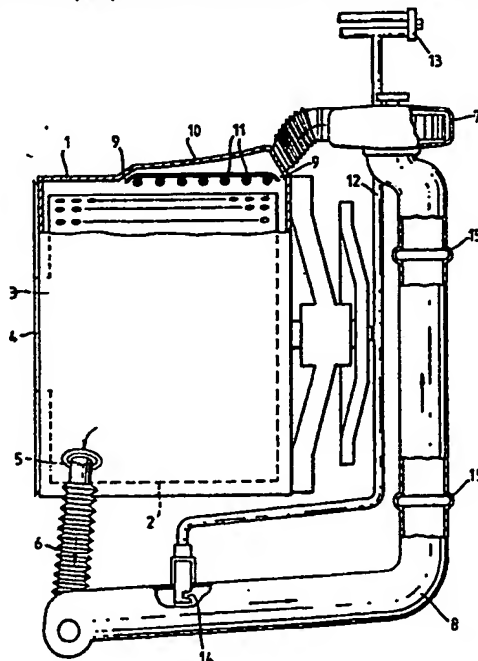
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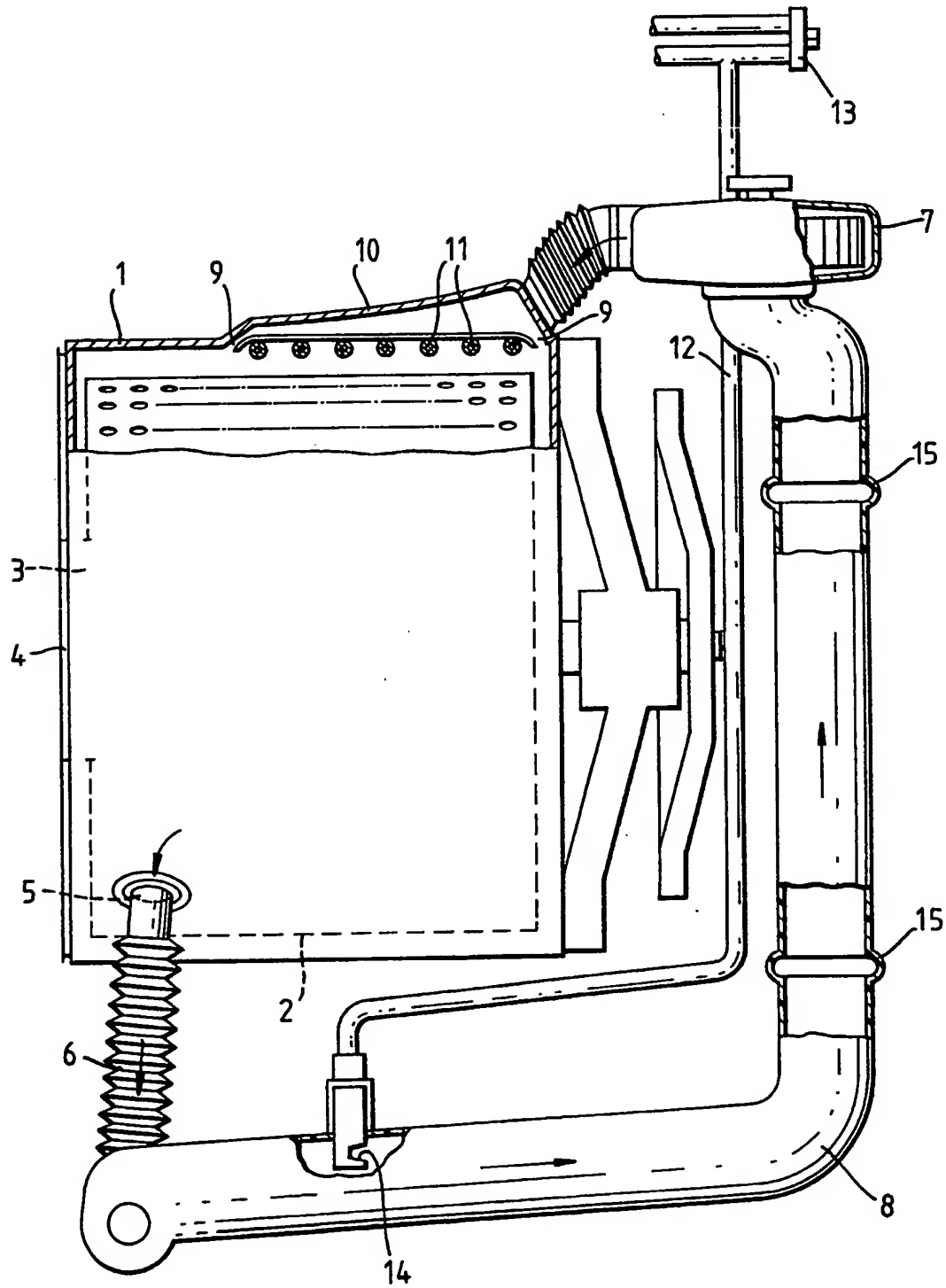
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## (54) Laundry drier with droplet removal

(57) A combined laundry-washing and -drying machine comprises a washing tub within which a drum is rotatably mounted and is capable of containing the laundry both during the washing operation and during the drying operation, a pneumatic drying circuit comprising a fan 7 and a condensation device, the fan being arranged to push dry heated air into contact with the laundry, by way of a conduit provided with heating elements, and to draw in the hot wet air by way of the discharge opening of the tub and through the condensation device, the condensation device being of substantially tubular form and having associated with it at least one spray nozzle 14 for providing a spray within the device for inducing condensation of moisture in the air, the nozzle or nozzles being connected to the water system via a control valve, wherein the portion of the condensation device which is disposed between the fan and the cooling water spray nozzle or nozzles has a plurality of annular enlargements 15 in its peripheral cross-section, so that droplets in the air are driven against the wall of the condensation device.





CONDENSATION DEVICE FOR A COMBINED MACHINE  
FOR WASHING AND DRYING LAUNDRY

The present invention concerns a condensation  
5 device for a combined machine for washing and drying  
laundry.

In particular the invention relates to a front  
loading domestic electrical appliance provided with a tub  
within which a drum can rotate about a horizontal axis and  
10 is capable of containing the laundry both during the washing  
operation and during the drying operation.

The drying process may be effected either by means  
of an open circuit for the drying air which is taken in from  
the outside atmosphere, heated, brought into contact with  
15 the laundry and then discharged to the outside of the  
machine in a moist and hot condition, or by means of a  
closed circuit for air which is forced to pass successively  
through a heating device, the drum containing the laundry, a  
dehumidifier device and then returned to the circuit again,  
20 as described for example in British patent No 2172978.

The washing-drying machines which provide a closed  
circuit for the drying air generally use water-cooled  
condensation devices in which the drying air is dehumidified  
by passing through curtains of atomised water or by flowing  
25 over condensation surfaces which are wetted in counterflow  
relationship by a film of cooling water.

Those condensation devices are found to suffer  
from the disadvantage of entrainment of droplets of cooling  
water by the flow of drying air which passes through the  
30 condensation device. It will be apparent that such cooling  
water infiltration phenomena have an adverse effect on the  
efficiency of the machine during the drying operation.

In order to remedy those disadvantages,  
condensation devices have been proposed in which the film of  
35 cooling water is screened from the flow of drying air in

counter-flow relationship by means of separator baffles which extend longitudinally within the condenser as described in above mentioned British patent No 2172978.

Otherwise, in the case of machines in which the drying air is guided to pass through atomised curtains of cooling water, condensation devices have been proposed, which are provided with transverse gutter members for collecting the droplets of water which are caught by the drying flow, as is the case for example in the laundry drier described in French patent No 2354411.

Those expedients reduce the effect of the cooling water being entrained but on the other hand they cause substantial complication in the construction of the condenser, particularly in a case where the latter has to be produced by means of plastics material moulding processes.

Thus, the main aims of the present invention are to provide a condensation device for washing-drying machines, which is of a simple construction and which eliminates or further reduces the phenomenon of entrainment of the cooling water.

According to the present invention, there is provided a combined laundry-washing and -drying machine comprising a washing tub within which a drum is rotatably mounted and is capable of containing the laundry both during the washing operation and during the drying operation, a pneumatic drying circuit comprising a fan and a condensation device, the fan being arranged to push dry heated air into contact with the laundry, by way of a conduit provided with heating elements, and to draw in the hot wet air by way of the discharge opening of the tub and through the condensation device, the condensation device being of substantially tubular form and having associated with it at least one spray nozzle, for providing a spray within the device for inducing condensation of moisture in the air, the nozzle or nozzles being connected to the water

system via a control valve, wherein the portion of the condensation device which is disposed between the fan and the cooling water spray nozzle or nozzles has a plurality of annular enlargements in its peripheral cross-section.

5           The features of the device according to the invention will be more clearly apparent from the following description which is set forth by way of non-limiting example, with reference to the accompanying diagrammatic drawing in which the single figure is a partly sectional  
10 side view of a laundry washing-drying machine provided with a preferred embodiment of the device according to the invention.

          The washing-drying machine shown in the drawing substantially comprises a tub 1 in which a drum 2 for  
15 containing the laundry to be washed and dried is mounted rotatably about a horizontal axis.

          The drum 2 is driven in rotation by an electric motor and belt transmission arrangements which are known per se and therefore not illustrated, and has a front loading  
20 opening 3 which is aligned with the front opening 4 of the tub and the front opening in the external casing (not shown) of the washing-drying machine.

          The washing tub 1 has a lower opening 5 which is connected by means of a conduit 6 to a filter device and to  
25 a discharge pump and a discharge conduit which are not shown but which are capable of draining the washing solution from the machine at the end of the washing and rinsing cycles.

          After the washing process the machine is also able to provide for drying of the laundry in known manner by  
30 means of a flow of heated air which is caused to circulate through the drum 2 and the wet laundry and which is successively drawn in from the tub, dehumidified, heated and returned to the tub 1.

          For that purpose, the machine has a fan 7, the  
35 suction intake side of which is connected to the discharge

conduit 6 of the tub 1 by means of a water-cooled condensation device 8 while the delivery side of the fan 7 is connected to an upper opening 9 in the tub 1 by way of conduit 10 provided with heating elements 11 of electrical resistance type. The condensation device 8 of known type is of substantially tubular form and is produced by blow moulding of plastics material.

The condenser 8 is connected to the water system by means of a conduit 12 and an electrically operated valve 13 which supplies a spray nozzle 14 with the water required to create a condensation curtain for the wet air coming from the tub 1.

The cooling water and the condensation water are then conveyed by the inclined bottom of the condenser 8 towards the discharge pump which provides for draining same from the machine.

As already described in the preamble the flow of air which is drawn by the fan 7 tends to entrain the atomised water which is sprayed by the nozzle 14 and transport it into the drying circuit.

In the condensation device 8 according to the invention that disadvantage is overcome by virtue of the fact that the water which is drawn in by the fan 7 is intercepted by a plurality of annular enlargements 15 in cross-section, which are provided in the body of the condenser 8 and downstream of the nozzle 14 in the direction of flow of the drying air (as indicated by the arrows).

In fact, laboratory tests have demonstrated that the droplets of water which are transported by the drying air tend to take up positions peripherally in relation to the flow of air under the effect of centrifugal force produced by the helical movement of the flow of air.

Consequently, the droplets of water go to be collected in the annular enlargements 15 in order by cohesion to form larger drops which run along the condenser

8 and towards the discharge pump without being entrained again in the opposite direction by the flow of air.

That arrangement makes it possible to eliminate or at least minimise the amount of water which is carried off by the drying air and at the same time substantially to simplify the construction of the condenser 8.

The drawing shows by way of example two annular enlargements 15 but it will be apparent that there may be a different number thereof without thereby departing from the scope of the main features claimed hereinafter. It will be apparent that the device according to the invention may provide more spray nozzles and may also be used to advantage in washing-drying machines which are different from front-loading machines.



CLAIMS

1. A combined laundry-washing and -drying machine comprising a washing tub within which a drum is rotatably mounted and is capable of containing the laundry both during the washing operation and during the drying operation, a pneumatic drying circuit comprising a fan and a condensation device, the fan being arranged to push dry heated air into contact with the laundry, by way of a conduit provided with heating elements, and to draw in the hot wet air by way of the discharge opening of the tub and through the condensation device, the condensation device being of substantially tubular form and having associated with it at least one spray nozzle, for providing a spray within the device for inducing condensation of moisture in the air, the nozzle or nozzles being connected to the water system via a control valve, wherein the portion of the condensation device which is disposed between the fan and the cooling water spray nozzle or nozzles has a plurality of annular enlargements in its peripheral cross-section.

2. A machine according to claim 1 wherein the annular enlargements are provided in a vertical portion of the condensation device.

3. A machine according to claim 1 or 2 and which is a front-loading type.

4. A combined laundry-washing and -drying machine constructed and arranged to operate substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.